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Making Acquisition Measurable

Kevin Buck and Diane Hanf, The MITRE Corporation

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Prepared for the Naval Postgraduate School, Monterey, California 93943

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14. ABSTRACT
The ultimate objective of our investigations was to establish a foundation for improving how acquisition performance is managed. Our project looked broadly across the four principles highlighted in NDAA Section 804 and subsequently focused on the challenges that program managers might face in measuring adoption and impact of the user engagement principle. We discovered that the principles are interrelated and that an understanding of how acquisition success will be measured is critical to understanding the principles? contribution to successful acquisition outcomes. Our research focused most extensively on the challenges that Government program offices face in ensuring early and continual involvement of the user, measuring/monitoring user engagement in achieving program/system objectives, and determining the impact of user involvement. Based on direct interaction with users of Government systems and program capabilities, our research resulted in the identification of essential elements for an effective user engagement program, codification of key user types and characteristics, candidate high-priority user engagement metrics, lessons learned in deriving metrics, relevance of performance management principles for measuring user engagement, and insights from users for improving how program offices can more effectively and efficiently engage users in the process of delivering required capabilities.

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To request Defense Acquisition Research or to become a research sponsor, please contact:

NPS Acquisition Research Program
Attn: James B. Greene, RADM, USN, (Ret.)
Acquisition Chair
Graduate School of Business and Public Policy
Naval Postgraduate School
555 Dyer Road, Room 332
Monterey, CA 93943-5103
Tel: (831) 656-2092
Fax: (831) 656-2253
E-mail: jbgreene@nps.edu

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Preface & Acknowledgements

During his internship with the Graduate School of Business & Public Policy in June 2010, U.S. Air Force Academy Cadet Chase Lane surveyed the activities of the Naval Postgraduate School's Acquisition Research Program in its first seven years. The sheer volume of research products—almost 600 published papers (e.g., technical reports, journal articles, theses)—indicates the extent to which the depth and breadth of acquisition research has increased during these years. Over 300 authors contributed to these works, which means that the pool of those who have had significant intellectual engagement with acquisition issues has increased substantially. The broad range of research topics includes acquisition reform, defense industry, fielding, contracting, interoperability, organizational behavior, risk management, cost estimating, and many others. Approaches range from conceptual and exploratory studies to develop propositions about various aspects of acquisition, to applied and statistical analyses to test specific hypotheses. Methodologies include case studies, modeling, surveys, and experiments. On the whole, such findings make us both grateful for the ARP's progress to date, and hopeful that this progress in research will lead to substantive improvements in the DoD's acquisition outcomes.

As pragmatists, we of course recognize that such change can only occur to the extent that the potential knowledge wrapped up in these products is put to use and tested to determine its value. We take seriously the pernicious effects of the so-called "theory–practice" gap, which would separate the acquisition scholar from the acquisition practitioner, and relegate the scholar's work to mere academic "shelfware." Some design features of our program that we believe help avoid these effects include the following: connecting researchers with practitioners on specific projects; requiring researchers to brief sponsors on project findings as a condition of funding award; "pushing" potentially high-impact research reports (e.g., via overnight shipping) to selected practitioners and policy-makers; and most notably, sponsoring this symposium, which we craft intentionally as an opportunity for fruitful, lasting connections between scholars and practitioners.

A former Defense Acquisition Executive, responding to a comment that academic research was not generally useful in acquisition practice, opined, "That's not their [the academics'] problem—it's ours [the practitioners']. They can only perform research; it's up to us to use it." While we certainly agree with this sentiment, we also recognize that any research, however theoretical, must point to some termination in action; academics have a responsibility to make their work intelligible to practitioners. Thus we continue to seek projects that both comport with solid standards of scholarship, and address relevant acquisition issues. These years of experience have shown us the difficulty in attempting to balance these two objectives, but we are convinced that the attempt is absolutely essential if any real improvement is to be realized.

We gratefully acknowledge the ongoing support and leadership of our sponsors, whose foresight and vision have assured the continuing success of the Acquisition Research Program:

- Office of the Under Secretary of Defense (Acquisition, Technology & Logistics)
- Program Executive Officer SHIPS
- Commander, Naval Sea Systems Command
- Army Contracting Command, U.S. Army Materiel Command
- Program Manager, Airborne, Maritime and Fixed Station Joint Tactical Radio System

- Program Executive Officer Integrated Warfare Systems
- Office of the Assistant Secretary of the Air Force (Acquisition)
- Office of the Assistant Secretary of the Army (Acquisition, Logistics, & Technology)
- Deputy Assistant Secretary of the Navy (Acquisition & Logistics Management)
- Director, Strategic Systems Programs Office
- Deputy Director, Acquisition Career Management, US Army
- Defense Business Systems Acquisition Executive, Business Transformation Agency
- Office of Procurement and Assistance Management Headquarters, Department of Energy

We also thank the Naval Postgraduate School Foundation and acknowledge its generous contributions in support of this Symposium.

James B. Greene, Jr.
Rear Admiral, U.S. Navy (Ret.)

Keith F. Snider, PhD
Associate Professor

Panel 4 – Improving IT Acquisition

Wednesday, May 11, 2011	
11:15 a.m. – 12:45 p.m.	**Chair: Michael McGrath,** Vice President, Systems & Operations Analysis, Analytic Services, Inc. ***IT Acquisition: Expediting the Process to Deliver Business Capabilities to the DoD Enterprise*** Jacques Gansler and William Lucyshyn, University of Maryland ***Making Acquisition Measurable*** Kevin Buck and Diane Hanf, The MITRE Corporation ***Command and Control Rapid Prototyping Continuum (C2RPC) Transition: Bridging the Valley of Death*** Nicholas Gizzi, PMW 150

Michael McGrath—Vice President, Systems and Operations Analysis (SOA), Analytic Services, Inc. Dr. McGrath became the vice president in October 2007. He leads ANSER's operations in the Science and Technology, Enterprise Systems and Planning, and Operations Analysis and Management mission areas. He is responsible for developing and delivering services that enable the clients of Analytical Services, Inc., to address critical challenges in national security and public safety, and to improve the effectiveness of public-sector programs. Dr. McGrath leads a workforce whose expertise spans a wide range of technology and application domains in research, acquisition, information systems and defense operations.

Dr. McGrath served as Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation from February 2003 to September 2007. His role was to aggressively drive new technologies from all sources across Navy and Marine Corps platforms and systems and to develop programs to bridge the gap in transitioning from science and technology to acquisition. He was also responsible for integrating test and evaluation with the evolutionary acquisition process. His leadership was key to the restructuring of the Future Naval Capabilities program, the success of the Rapid Technology Transition program, and the establishment of the Navy Enterprise T&E Board of Directors and the Navy Lab and Centers Competency Group.

Prior to his return to government service in 2003, Dr. McGrath spent five years as vice president for Government Business at the Sarnoff Corporation, a leading R&D company with both commercial and government clients. He was responsible for developing programs to meet government needs for innovative dual use technologies in sensors and microelectronics, networking and information technology, and bio-technology.

Dr. McGrath's previous government experience includes weapon system logistics planning and management at Naval Air Systems Command, acquisition policy in the Office of the Secretary of Defense, and several technology management positions. He was the first OSD Director of the Computer-aided Acquisition and Logistics Support program. At DARPA, he managed programs in Agile Manufacturing, Electronic Commerce Resource Centers, and Affordable Multi Missile Manufacturing. He also served in leadership positions for several DoD-wide initiatives to improve manufacturing and reduce the cost of defense systems. As the Assistant Deputy Under Secretary of Defense (Dual Use and Commercial Programs), he directed the Commercial Technology Insertion Program, the Commercial Operating and Support Savings Initiative, and the Department's Title III industrial base investments.

Dr. McGrath holds a BS in Space Science and Applied Physics (1970) and an MS in Aerospace Engineering (1972) from Catholic University, and a doctorate in Operations Research from George Washington University (1985). He was an adjunct associate professor at GWU in 1987–1988. He is active in several industry associations and study groups, including studies by the Defense Science Board and the National Research Council.

Making Acquisition Measurable

Kevin Buck—Principal Economics and Business Analyst, Center for Acquisition and Systems Analysis (CASA). Mr. Buck provides investment, portfolio, and performance analyses and management solutions for Defense, Intelligence, and Civilian Agency sponsors. He is a Principal Investigator for a MITRE research project related to streamlining transparency, accountability, and performance management Improvement. Mr. Buck has a Bachelor of Science in Marine Transportation from the U.S. Merchant Marine Academy, and a Master of Science in Industrial Administration from Carnegie-Mellon University. He has served in the U.S. Navy (enlisted and officer). [kbuck@mitre.org]

Diane Hanf—conducts multi-discipline, systems/software engineering and acquisition investigations on various technology assets, such as Web 2.0-based services and applications. She is currently conducting research on the use of gaming to investigate acquisition changes needed to support rapidly changing component-based systems. Ms. Hanf has bachelor's degrees in Electrical Engineering (Oklahoma State), Wire Communications Technology, and Business Administration (Wayland Baptist) and a Master of Science degree in Systems Engineering from Johns Hopkins University. [dhanf@mitre.org]

Abstract

The ultimate objective of our investigations was to establish a foundation for improving how acquisition performance is managed. Our project looked broadly across the four principles highlighted in NDAA Section 804 and subsequently focused on the challenges that program managers might face in measuring adoption and impact of the user engagement principle. We discovered that the principles are interrelated and that an understanding of how acquisition success will be measured is critical to understanding the principles' contribution to successful acquisition outcomes. Our research focused most extensively on the challenges that Government program offices face in ensuring early and continual involvement of the user, measuring/monitoring user engagement in achieving program/system objectives, and determining the impact of user involvement. Based on direct interaction with users of Government systems and program capabilities, our research resulted in the identification of essential elements for an effective user engagement program, codification of key user types and characteristics, candidate high-priority user engagement metrics, lessons learned in deriving metrics, relevance of performance management principles for measuring user engagement, and insights from users for improving how program offices can more effectively and efficiently engage users in the process of delivering required capabilities.

Report Summary

"Information technology (IT) offers immense capability in terms of agility, flexibility, responsiveness, and effectiveness. It enables nearly all of our military combat capability and has become a necessary element of our most critical warfare systems. However, there is growing concern within Congress and among DOD leadership that the nation's military advantage may be eroding. The deliberate process through which weapon systems and information technology are acquired by DOD cannot keep pace with the speed at which new capabilities are being introduced in today's information age—and the speed with which potential adversaries can procure, adapt, and employ those same capabilities against the United States."

– Defense Science Board (2009)

MITRE Technical Report (MTR) 110102, "Making Acquisition Measurable—FY 2010 NDAA Section 804 Principles" summarizes the results of preliminary investigations undertaken by MITRE's "Making Acquisition Measurable" (MAM) Capability Development Team to support Government programs in measuring the adoption and impact of four Information Technology (IT) acquisition principles. These principles are identified within Section 804 of the FY 2010 National Defense Authorization Act (NDAA) as critical to a new IT acquisition process that must be created by the Department of Defense (DoD). The four principles include:

- Early and continual involvement of the user;
- Multiple, rapidly executed increments or releases of capability;
- Early, successive prototyping to support an evolutionary approach; and
- A modular, open-systems approach.

The ultimate objective of our investigations was to establish a foundation for improving how acquisition performance is managed. The absence of a formalized and standard performance management methodology has been noted by the House Armed Services Committee Panel on Defense Acquisition Reform as a critical area of weakness. To create a foundation for improved performance management, the team needed to better understand how program managers can more effectively and efficiently do the following:

- Account for the unique nature of IT in their performance measurement and program management;
- Apply performance metrics to determine whether desired outcomes from their programs and acquisitions will likely be achieved;
- Identify in a proactive manner whether course corrections are needed or expectations should be adjusted;
- Leverage best practices, lessons learned, and existing tools/analyses to improve data collection, performance measurement, acquisition monitoring, and acquisition execution decision-making; and
- Ensure that performance management efforts support improved performance (e.g., timely delivery of required capabilities, services, or products to the end-user).

The project looked broadly across the four principles highlighted in NDAA Section 804 and subsequently focused on the challenges that program managers might face in measuring adoption and impact of the user engagement principle. We discovered that the principles are interrelated and that an understanding of how acquisition success will be measured is critical to understanding the principles' contribution to successful acquisition outcomes. Figure 1 illustrates key relationships among the four principles.

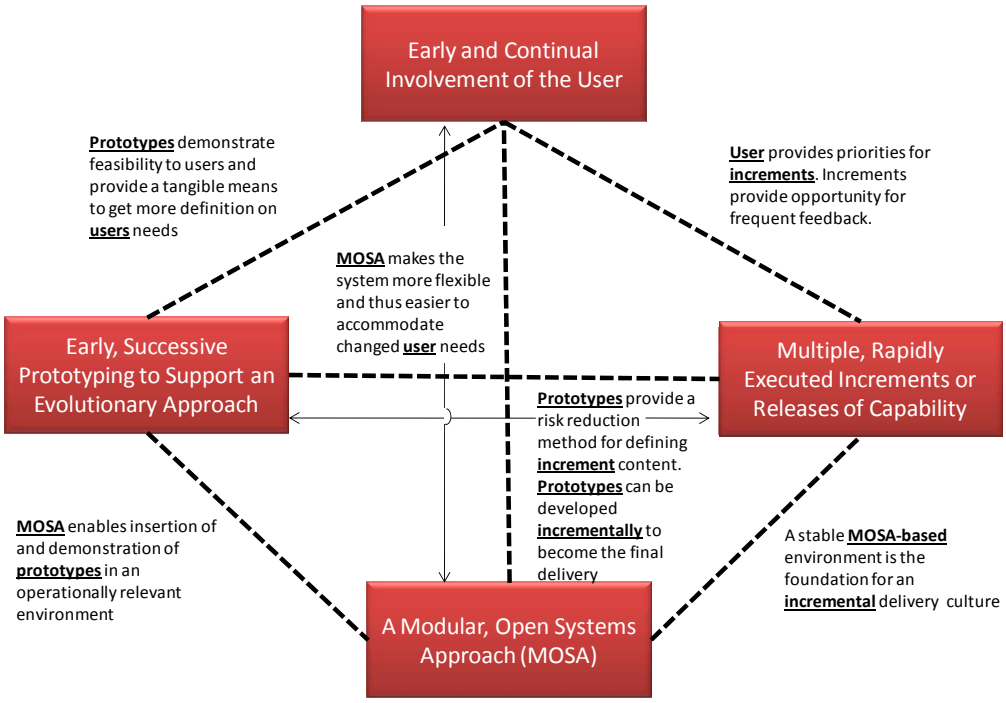

Figure 1. Relationship Among Section 804 Principles

Incremental deliveries and supporting underlying processes, for instance, should provide early opportunities to learn about the changing user environment. Designing user interfaces using MOSA principles should reduce user training needs and allow for more rapid deployment of components that have changed because of user needs. Applying prototypes should provide a tangible presentation of the evolving or proposed system, which should enrich user-developer interactions.

Our research focused most extensively on the challenges that Government program offices face in ensuring early and continual involvement of the user, measuring/monitoring user engagement in achieving program/system objectives, and determining the impact of user involvement. Based on direct interaction with users of Government systems and program capabilities, our research resulted in the identification of essential elements for an effective user engagement program, codification of key user types and characteristics, candidate high-priority user engagement metrics, lessons learned in deriving metrics, relevance of performance management principles for measuring user engagement, and insights from users for improving how program offices can more effectively and efficiently engage users in the process of delivering required capabilities.

References

Defense Science Board (DSB). (2009, March). *Report of the Defense Science Board (DSB) task force on DoD policies and procedures for the acquisition of IT*. Washington, DC: Author.

MITRE. (2010). *Making acquisition measurable—FY 2010 NDAA section 804 principles* (MTR Technical Report 110102). McLean, VA: Author.

Making Acquisition Measurable

FY 2010 National Defense Authorization Act (NDAA) Section 804 Principles

Naval Postgraduate School 8th Annual Acquisition Research Symposium
May 10-13, 2011
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Kevin S. Buck, E523 (kbuck@mitre.org), 443-636-5380
Diane Hanf, E547 (dhanf@mitre.org) , 339-223-5380

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Agenda

- **Motivation**
- **Objective**
- **Early and Continual Involvement of the User**
  - Engaging with Users
  - Different Types of Users Targeted
  - Proposed User Engagement Program
  - Proposed User Engagement Metrics Categories
  - Proposed High Priority User Engagement Metrics
- **Best Practices Mapped to New IT Acquisition**
- **Relationships among Section 804 Principles**
- **Key Discoveries**
- **About Metrics Derivation**
- **Recommendations for Your Program Office**
- **Applying What We Learned to Developing a New System**
  - What is Composable Capability on Demand (CCOD ®)
  - Acquisition for Composable Systems
- **References**

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Motivation

- **Department of Defense (DoD) was directed by Congress to design a new IT acquisition process**
  - Direction references Chapter 6 of the March 2009 Defense Science Board (DSB) Task Force Report on Policies and Procedures for the Acquisition of IT
  - The mandate targets four principles:
    - Early and continual user involvement
    - Multiple, rapidly executed increments or releases of capability
    - Early, successive prototyping to support an evolutionary acquisition
    - Modular, open systems approach (MOSA)
- **How will programs measure, monitor, and report adoption of the principles in the new process?**
  - Need a foundation for improving how acquisition performance is managed
    - According to the House Armed Services Committee Panel on Defense Acquisition Reform, a critical area of weakness is the lack of a formalized performance management methodology

**2010 National Defense Authorization Act (NDAA) Section 804, "Implementation of New Acquisition Process for IT Systems"*

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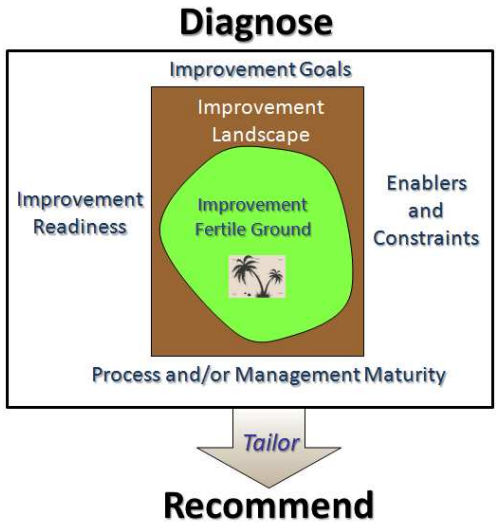
Objective

- **Help programs effectively measure, monitor, and report progress in achieving IT acquisition outcomes**
  - Desired impact:
    - Increased agility
    - Reduced cost growth
    - Increased meaningful deliveries

Flexibility

and

Speed



- **Propose a diagnostic to help IT programs manage performance**
- **Accommodate tailoring**

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Engaging with Users

- **Our focus was on Early and Continual User Involvement (UI)**
  - We first interviewed users across Federal government programs
- **What we heard from users during our interviews:**
  - "We liked it when they came to us, showed us a new capability and then returned with changes that we had suggested"
  - Developers should not be involved too early in the process
  - "The program office should come out and see the pain that we experience using the system; they would understand the requirement better"
  - "Users should also talk amongst themselves"
  - User representatives in the program office should come from the users' organization
  - "Consistency in interactions on a cadence that is predictable is important to obtaining desired capabilities"

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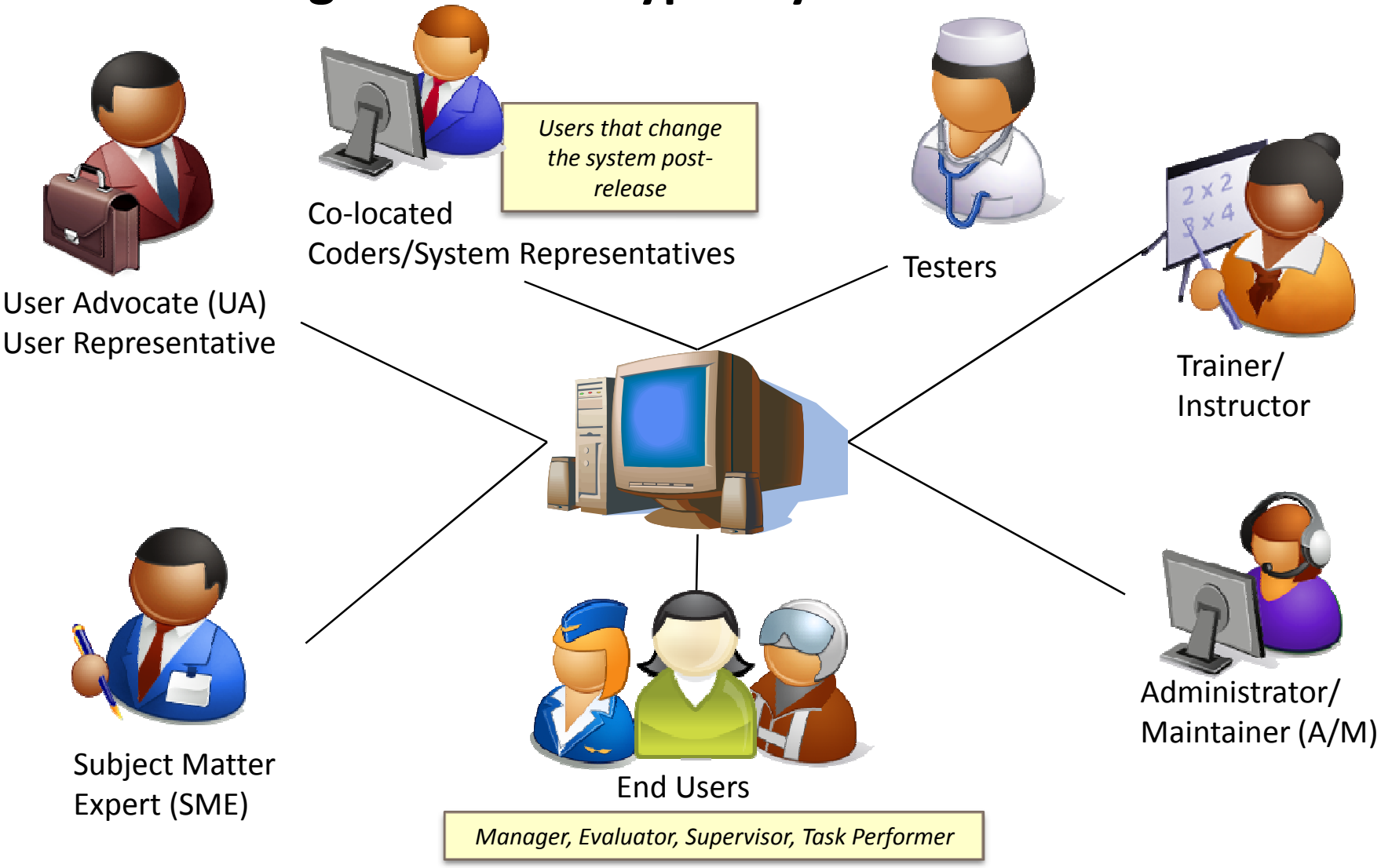
Different Types of Users Targeted

- **We identified a number of different types of users with whom Program Offices typically must interact**



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Proposed User Engagement Program

- **Based on our investigations, we recommend key elements of a "User Engagement Program"**

Effective and Efficient User Engagement

Fundamental Leading Indicators:

(1) Are users engaging?

(2) Are the right users engaging with the right PMO reps?

(3) Are the right engagement approaches applied?

(4) Are the right events and issues driving the need to engage?

(5) Are user engagement feedback loops closed effectively and in a timely manner?

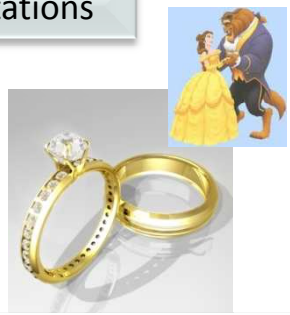
(6) Is the user engagement process enabled (resources, championship)?

Engagement Program

User Involvement Risk Reduction
Functionality Risk Reduction
Data/Information Verification

Goals, Impact & Value Expectations

User Representation



Commitments & Relationship Mgt

Engagement & Communication Methods

Processes & Plans Alignment and Tracking

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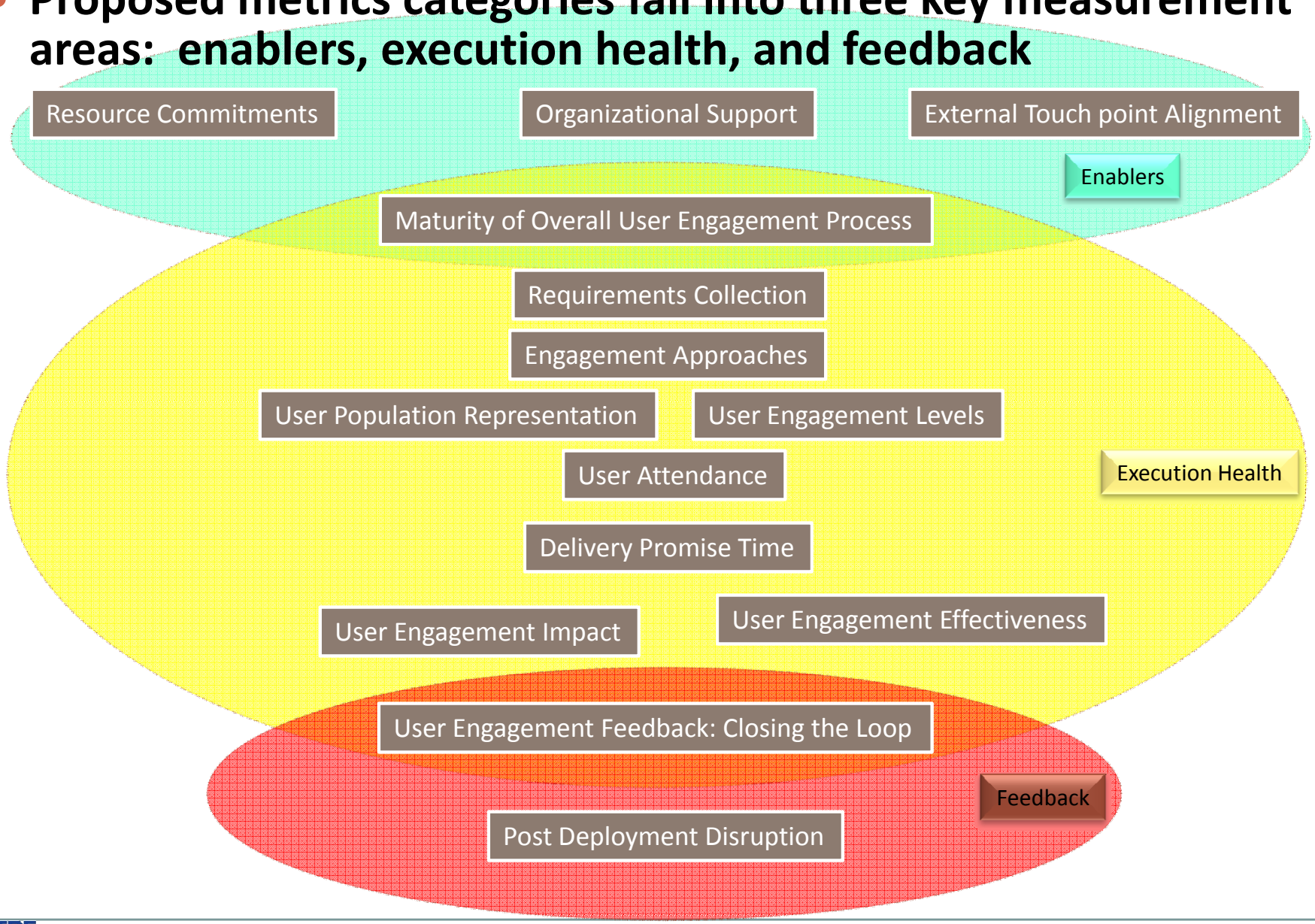
Proposed User Engagement Metrics Categories

- **Proposed metrics categories fall into three key measurement areas: enablers, execution health, and feedback**



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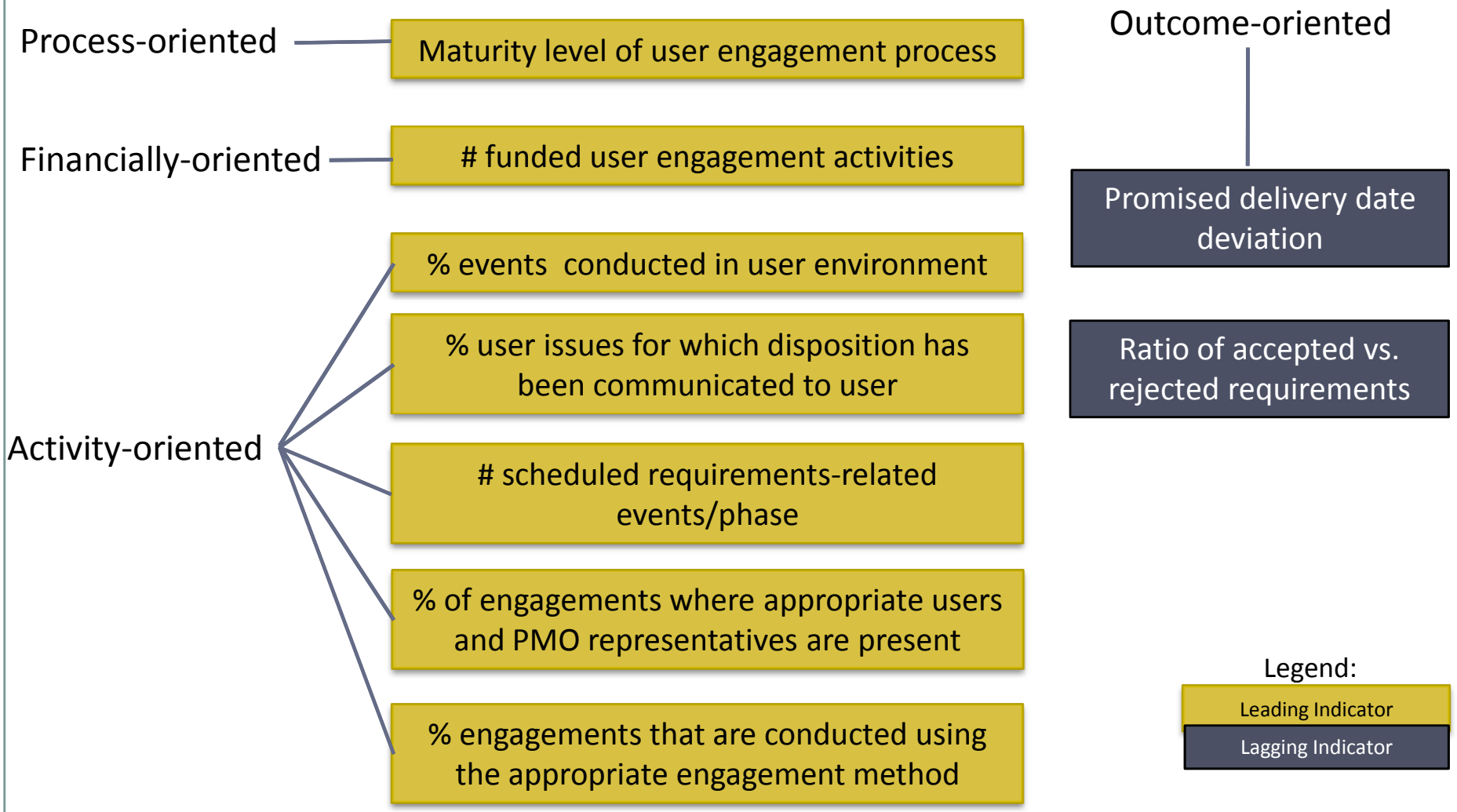
Proposed High Priority User Engagement Metrics

- **The most meaningful metrics for assessing current user engagement progress and impact will vary, but we suggest that Program Offices consider the following process-, financial-, activity-, and outcome-oriented metrics**



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About Metrics Derivation

- **Not everything that can be measured necessarily should be measured**
- **It is easy to identify metrics; it is much harder to identify the value of those metrics in demonstrating improvement progress and impact**
- **Context must be provided for metrics recommendations:**
  - Why this metric?
  - Method to measure and units of measure
  - Interdependencies and strength of interdependencies
  - Importance of metric to characterization of outcome achievement
  - Level of confidence that metric effectively communicates progress toward achievement of outcomes
  - Key perspectives of health characterized by the metric

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Applying Metrics Derivation Lessons

- **For example,**

% of engagements where appropriate users and PMO representatives are present

  - Why this metric?
    - Our investigations-to-date strongly suggest that key outcomes associated with acceptance of requirements and adherence with delivery schedules are strongly influenced by the % of engagements where the right users and PMO reps are present
  - Method to measure and units of measure

$$\left(\frac{\text{\# of engagements during the specified timeframe in which the most appropriate users and PMO reps are present}}{\text{\# of user engagements during the specified timeframe}} \right) \times 100$$

  - Interdependencies and strength of interdependencies
    - On a scale of weak to strong influence, this metric is strongly influenced by "maturity level of user engagement process"
    - Moderately influenced by "% events conducted in user environment"
  - Importance of metric to characterization of outcome achievement
    - On a scale of slightly to very important, this metric is moderately important to achievement of key outcomes associated with acceptance of requirements and adherence with delivery schedules
  - Level of confidence that metric effectively communicates progress toward achievement of outcomes
    - On a scale of 1 to 100, with 100 meaning extremely confident, we are 75% confident that this metric communicates progress toward achievement of outcomes
  - Key perspectives of health characterized by the metric
    - Key perspectives of health characterized by this metric include effectiveness of user engagements and efficiency associated with obtaining user feedback

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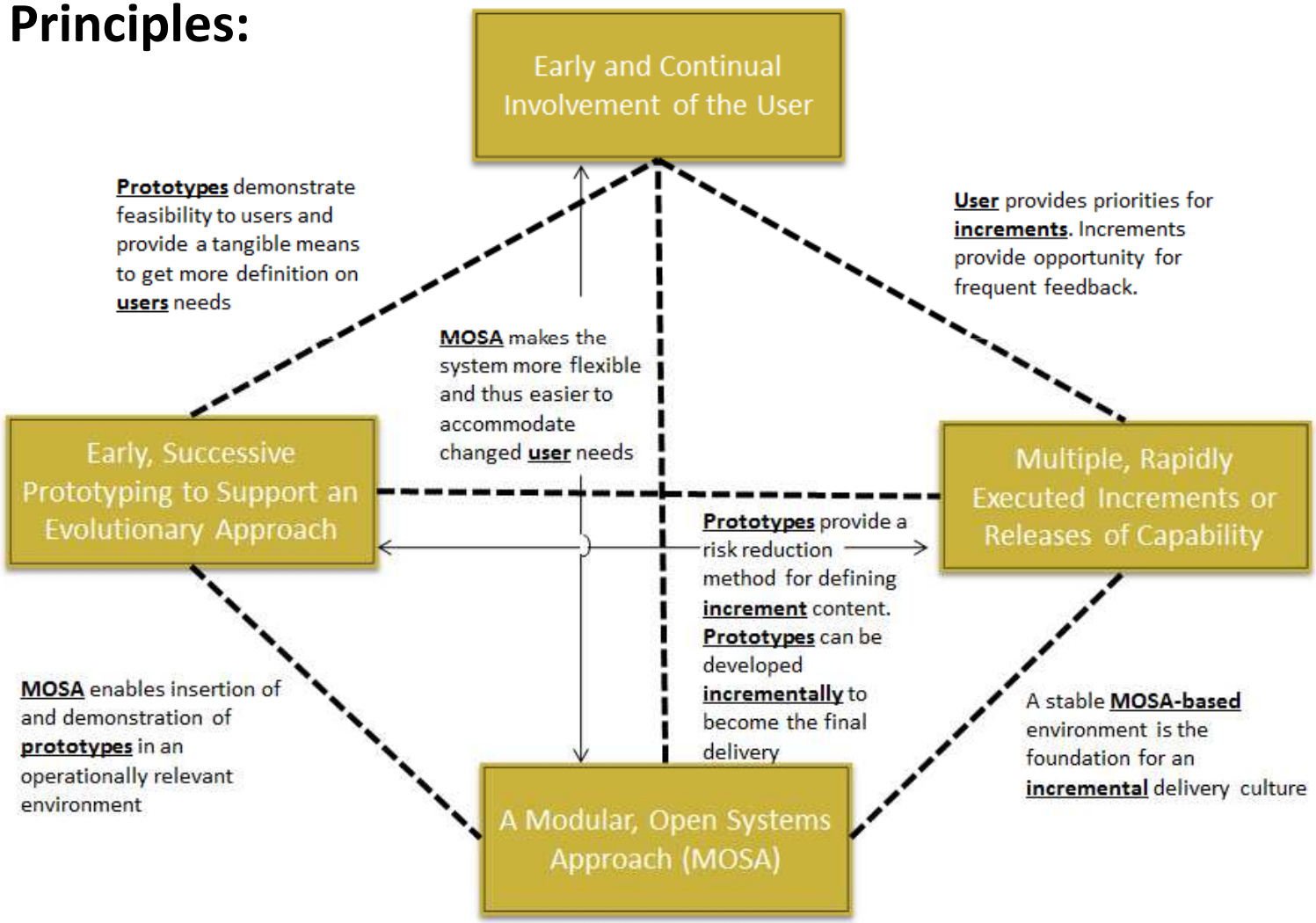
Relationships among Section 804 Principles

- **We then explored the relationships between Early and Continual User Involvement and the other three NDAA Section 804 Principles:**



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Best Practices Mapped to IT Acquisition *(per DSB Report)*

Best Practices Mapped to New IT Acquisition Lifecycle Phases	Business Case Analysis and Development	Architectural Development and Risk Reduction	Development & Demonstration	Operations & Support
Early and Continual Involvement of the User				
Voice of the customer	✓	✓	✓	✓
Customer relationship management supported by customer communications management	✓	✓	✓	✓
Customer satisfaction enabled by enterprise feedback management	✓	✓	✓	✓
Collaboration management	✓	✓	✓	
User-centered design & Usability			✓	
Customer service				✓
Multiple, Rapidly Executed Increments or Releases of Capabiltiy				
Capability Maturity Model Index (CMMI) - Acquisition (AQ)	✓	✓	✓	✓
CMMI-Development			✓	
Incremental iterative development (planning & execution)	✓	✓	✓	
Early, Successive Prototyping to Support an Evolutionary Approach				
Demonstration of applicable technology	✓	✓		
Demonstration of design possibilities		✓	✓	
Demonstration of requirements fulfillment		✓	✓	
MOSA				
Establish Enabling Environment	✓	✓	✓	
Employ Modular Design		✓	✓	
Designate Key Interfaces		✓	✓	
Use Open Standards		✓	✓	
Certify Conformance			✓	

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Key Discoveries

- **Government program application of some DSB-recommended principles** *(e.g., Multiple, Rapidly Executed Increments or Releases of Capability)* **is more advanced than for other principles** *(e.g., Early and Continual Involvement of the User)*
- **Considerable performance data is typically collected; should investigate its effectiveness for IT Acquisition programs**
- **Standardized methods within the DoD for selecting acquisition program metrics and monitoring performance could not be identified**
- **Measuring adoption of the principles will require considering program circumstances**
- **The four DSB-recommended principles within NDAA Section 804 are not necessarily the only important principles**
- **Need to share a common understanding of how the acquisition principles link to desired outcomes**

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Recommendations for Your Program Office

- Provide additional venues for users to communicate with procurement professionals (acquirers and developers)
- Let users know where their system program office is and how to provide good ideas to them
- Plan to align in situ capability development sessions with program increment planning to reduce requirements ambiguity
- When many systems deploy to a location, conduct a system environment study to determine impacts on user productivity
- Formulate an alliance with operating agencies to help alleviate non-performance of systems when deployed

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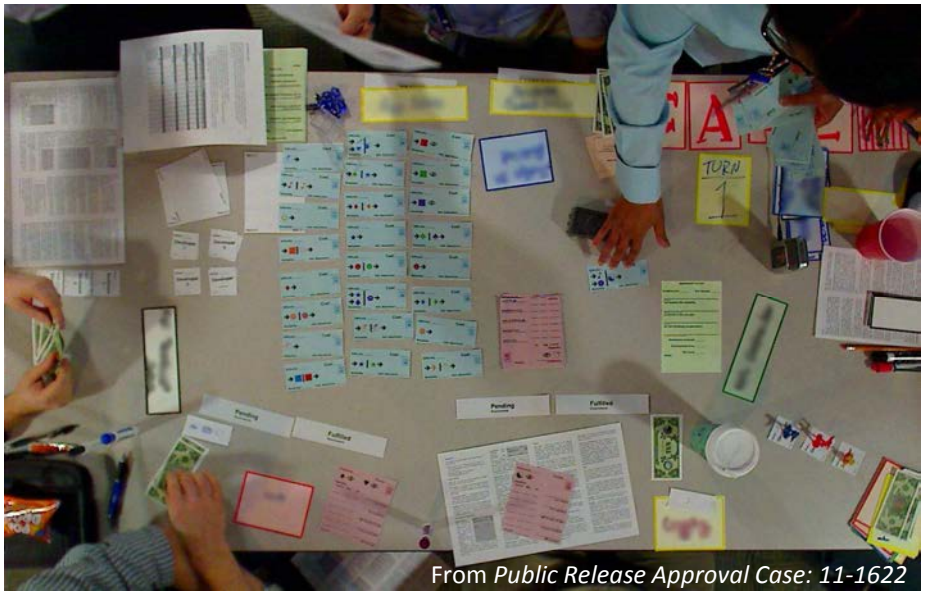
Applying What We Learned to Developing A New System

USING HIGH CONTACT USER ENGAGEMENT METHODS, SUCH AS GAMING, TO DEVELOP ACQUISITION STRATEGIES FOR COMPOSABLE CAPABILITIES ON-DEMAND (CCOD®)



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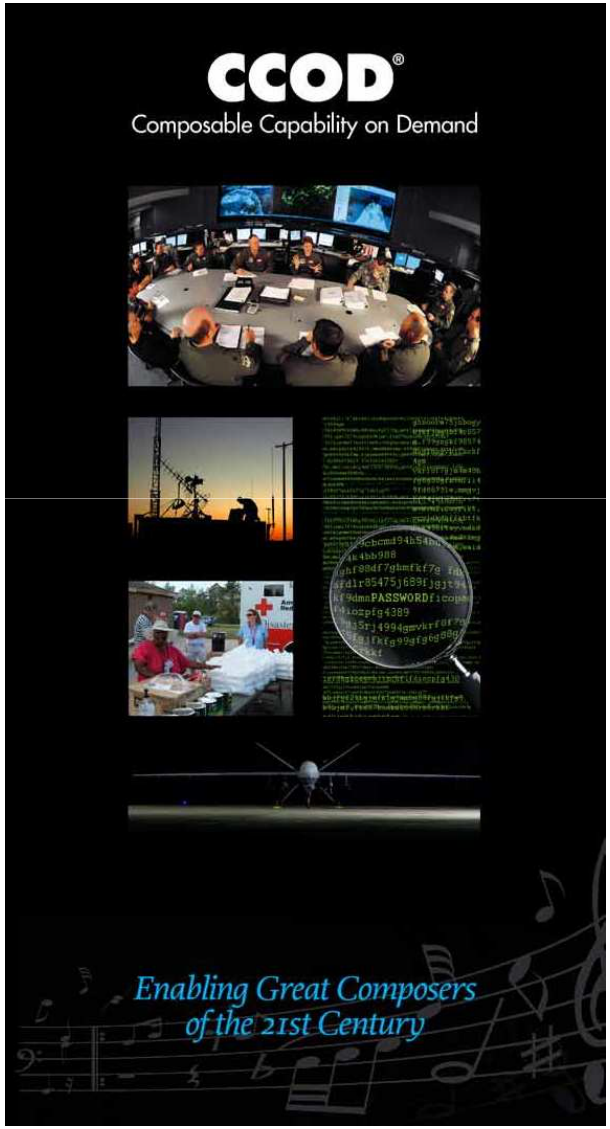
What is Composable Capability on Demand (CCOD ®)



- **A set of technical abilities that will enable DoD and civilian users to dynamically assemble and employ elements of the C4ISR enterprise**
- **Will allow the non-technocenti to adapt their enterprise according to the nature and scale of the mission**
- **Not a system**
  - CCOD consists of resources that can be formed or re-formed as needed
    - These resources are embedded within a distributed hybrid (fixed and mobile) infrastructure environment, that may not be locally provisioned
- **Draws mission information from traditional and nontraditional data sources to enhance situation awareness, collaboration, social networking, and decision support**
- **Will rely on a composable computational and network infrastructure for mission assurance**

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Acquisition for Composable Systems

- **Goal: Engage with various users of a proposed process to acquire and sustain composable systems**
- **Activities** [*]
  - Proposing acquisition approaches to achieve CCOD® objectives
  - Constructing games highlighting particular aspects of proposed CCOD® acquisition, and conducting exercises with Subject Matter Experts (SMEs) so that we can assess the value of the games for learning and evaluating acquisition effectiveness
  - Creating an environment to enable CCOD® acquisition game play:
    - Tabletop exercises
    - Electronic gaming in a distributed and asynchronous fashion
  - The environment may then be extended to experiment with a wide variety of acquisition processes with participation from many different stakeholders

[*] From *MITRE Public Release Approval Case: 11-1622*

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